



NATIONAL GUIDELINE CLEARINGHOUSE™ (NGC) GUIDELINE SYNTHESIS

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) PULMONARY REHABILITATION

Guidelines

1. **American College of Chest Physicians/American Association of Cardiovascular and Pulmonary Rehabilitation (ACCP/AACVPR).** [Pulmonary rehabilitation: joint ACCP/AACVPR evidence-based clinical practice guidelines](#). Chest 2007 May;131(5 Suppl):4S-42S. [211 references]
2. **Global Initiative for Chronic Obstructive Lung Disease (GOLD).** [Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease](#). Bethesda (MD): Global Initiative for Chronic Obstructive Lung Disease (GOLD); 2008. 94 p. [435 references]
3. **National Collaborating Centre for Chronic Conditions/National Institute for Health and Clinical Excellence (NCCCC/NICE).** [Chronic obstructive pulmonary disease. National clinical guideline on management of chronic obstructive pulmonary disease in adults in primary and secondary care](#). Thorax 2004 Feb;59 Suppl 1:1-232. [491 references]
4. **Singapore Ministry of Health (SMOH).** [Chronic obstructive pulmonary disease](#). Singapore: Singapore Ministry of Health; 2006 Oct. 84 p. [155 references]

INTRODUCTION

A direct comparison of the American College of Chest Physicians/American Association of Cardiovascular and Pulmonary Rehabilitation (ACCP/AACVPR), Global Initiative for Chronic Obstructive Lung Disease (GOLD), the National Collaborating Centre for Chronic Conditions (a collaborating center for the National Institute for Health and Clinical Excellence [NCCCC/NICE]), and Singapore Ministry of Health (SMOH) recommendations for pulmonary rehabilitation of patients with COPD is provided in the tables below.

The tables below provide a side-by-side comparison of key attributes of each guideline, including specific interventions and practices that are addressed. The language used in these tables, particularly that which is used in [Table 3](#), [Table 4](#), and [Table 5](#) is in most cases taken verbatim from the original guidelines:

- [Table 1](#) provides a quick-view glance at the primary interventions considered by each group and which make up the focus of this guideline synthesis.
- [Table 2](#) provides a comparison of the overall scope of the included guidelines.

- [Table 3](#) provides a more detailed comparison of the specific recommendations offered by each group for the topics under consideration in this synthesis, including:
 - [General Recommendations](#)
 - [Patient Selection](#)
 - [Exercise Training](#)
 - [Nutritional Intervention/Counseling](#)
 - [Education](#)
 - [Psychosocial/Behavioral Interventions](#)
 - [Follow-Up](#)
- [Table 4](#) lists the potential benefits associated with the implementation of each guideline as stated in the original guidelines.
- [Table 5](#) presents the rating schemes used by the guideline groups to rate the level of evidence and the strength of the recommendations.

A summary discussion of the [areas of agreement](#) and [areas of differences](#) among the guidelines is presented following the content comparison tables.

Abbreviations

- ACCP/AACVPR, American College of Chest Physicians/American Association of Cardiovascular and Pulmonary Rehabilitation
- COPD, chronic obstructive pulmonary disease
- GOLD, Global Initiative for Chronic Obstructive Lung Disease
- HRQOL, health related quality of life
- MRC, Medical Research Council
- NCCCC/NICE, National Collaborating Centre for Chronic Conditions/National Institute for Health and Clinical Excellence
- SMOH, Singapore Ministry of Health
- VMT, ventilatory muscle training

TABLE 1: COMPARISON OF INTERVENTIONS AND PRACTICES CONSIDERED <i>("✓" indicates topic is addressed)</i>				
	ACCP/AACVPR (2007)	GOLD (2008)	NCCCC/NICE (2004)	SMOH (2006)
General Recommendations	✓	✓	✓	✓
Patient Selection	✓	✓	✓	✓
Exercise Training	✓	✓	✓	✓
Nutritional Intervention/Counseling	✓	✓	✓	✓
Education	✓	✓	✓	✓

Psychosocial Interventions	✓	✓	✓	✓
Follow-Up	✓	✓		

TABLE 2: COMPARISON OF GUIDELINE SCOPE	
Objective and Scope	
ACCP/AACVPR (2007)	To update the 1997 guidelines published by ACCP and AACVPR and to examine new areas of research relevant to pulmonary rehabilitation based on a comprehensive literature review
GOLD (2008)	<ul style="list-style-type: none"> • To increase awareness of COPD and help the millions of people who suffer from this disease and die prematurely from it or its complications • To improve prevention and management of COPD through a concerted worldwide effort of people involved in all facets of health care and health care policy • To encourage an expanded level of research interest in this highly prevalent disease • To work toward combating the nihilistic attitude toward COPD by disseminating information about available treatments (both pharmacologic and nonpharmacologic) and by working with a network of experts—the GOLD National Leaders—to implement effective COPD management programs developed in accordance with local health care practices
NCCCC/NICE (2004)	<ul style="list-style-type: none"> • To develop a clinical guideline on the management of COPD for use in the National Health Service (NHS) in England and Wales • To offer best practice advice on the identification and care of patients with COPD • To define the symptoms, signs, and investigations required to establish a diagnosis of COPD • To define the factors that are necessary to assess the severity of COPD, provide prognostic information, and guide best management • To provide guidance on the pharmacological and nonpharmacological treatment of patients with stable COPD and on the management of exacerbations • To discuss the interface with surgery and intensive therapy units

SMOH (2006)	To give physicians a practical approach and guide to the care of COPD patients
Target Population	
ACCP/AACVPR (2007)	<ul style="list-style-type: none"> • United States • Any stable patient with a chronic lung disease who is disabled by respiratory symptoms
GOLD (2008)	Individuals at risk for or with COPD
NCCCC/NICE (2004)	<ul style="list-style-type: none"> • England and Wales • Adults who have a clinical working diagnosis of COPD, including chronic bronchitis, emphysema, and chronic airflow limitation/obstruction <p>Note: The guideline does not cover the management of people with asthma, bronchopulmonary dysplasia, and bronchiectasis, nor does it cover children.</p>
SMOH (2006)	<ul style="list-style-type: none"> • Singapore • Patients with known or suspected COPD
Intended Users	
ACCP/AACVPR (2007)	Advanced Practice Nurses Dietitians Nurses Occupational Therapists Physical Therapists Physician Assistants Physicians Respiratory Care Practitioners Social Workers
GOLD (2008)	Advanced Practice Nurses Allied Health Personnel Nurses Physician Assistants Physicians Public Health Departments Respiratory Care Practitioners
NCCCC/NICE (2004)	Advanced Practice Nurses Allied Health Personnel Dietitians Health Care Providers Hospitals

	Nurses Occupational Therapists Patients Physical Therapists Physicians Public Health Departments Respiratory Care Practitioners Students
SMOH (2006)	Physicians

TABLE 3: COMPARISON OF RECOMMENDATIONS

General Recommendations	
ACCP/AACVPR (2007)	<p>Comprehensive pulmonary rehabilitation programs include patient assessment, exercise training, education, and psychosocial support.</p> <p>The interdisciplinary team of health-care professionals in pulmonary rehabilitation may include physicians; nurses; respiratory, physical, and occupational therapists; psychologists; exercise specialists; and/or others with appropriate expertise. The specific team make-up depends on the resources and expertise available, but usually includes at least one full-time staff member.</p> <p>Recommendations</p> <ul style="list-style-type: none"> • Pulmonary rehabilitation improves the symptom of dyspnea in patients with COPD. Grade of Recommendation 1A • Pulmonary rehabilitation improves health related quality of life (HRQOL) in patients with COPD. Grade of Recommendation 1A • Pulmonary rehabilitation reduces the number of hospital days and other measures of health-care utilization in patients with COPD. Grade of Recommendation 2B • Pulmonary rehabilitation is cost-effective in patients with COPD. Grade of Recommendation 2C • There is insufficient evidence to determine if pulmonary rehabilitation improves survival in patients with COPD. No recommendation is provided. • There are psychosocial benefits from comprehensive pulmonary rehabilitation programs in patients with COPD. Grade of Recommendation 2B

	<ul style="list-style-type: none"> • Six to 12 weeks of pulmonary rehabilitation produces benefits in several outcomes that decline gradually over 12 to 18 months. Grade of Recommendation 1A. Some benefits, such as HRQOL, remain above control at 12 to 18 months. Grade of Recommendation 1C • Longer pulmonary rehabilitation programs (12 weeks) produce greater sustained benefits than shorter programs. Grade of Recommendation 2C • Maintenance strategies following pulmonary rehabilitation have a modest effect on long-term outcomes. Grade of Recommendation 2C • Current scientific evidence does not support the routine use of anabolic agents in pulmonary rehabilitation for patients with COPD. Grade of Recommendation 2C • Pulmonary rehabilitation is beneficial for some patients with chronic respiratory diseases other than COPD. Grade of Recommendation 1B • Although no recommendation is provided since scientific evidence is lacking, current practice and expert opinion suggest that pulmonary rehabilitation for patients with chronic respiratory diseases other than COPD should be modified to include treatment strategies specific to individual diseases and patients in addition to treatment strategies common to both COPD and non-COPD patients.
GOLD (2008)	<p><i>Rehabilitation</i></p> <p>The principal goals of pulmonary rehabilitation are to reduce symptoms, improve quality of life, and increase physical and emotional participation in everyday activities. To accomplish these goals, pulmonary rehabilitation covers a range of non-pulmonary problems that may not be adequately addressed by medical therapy for COPD. Such problems, which especially affect patients with <i>Stage II: Moderate COPD</i>, <i>Stage III: Severe COPD</i>, and <i>Stage IV: Very Severe COPD</i>, include exercise de-conditioning, relative social isolation, altered mood states (especially depression), muscle wasting, and weight loss. These problems have complex interrelationships and improvement in any one of these interlinked processes can interrupt the "vicious circle" in COPD so that positive gains occur in all aspects of the illness (see Figure 5.3-9 in the original guideline document). Comprehensive statements on pulmonary rehabilitation are available.</p> <p>See Figure 5.3-10 in the original guideline document for a list of benefits of pulmonary rehabilitation in COPD.</p>

	<p><u>Components of Pulmonary Rehabilitation Programs</u></p> <p>The components of pulmonary rehabilitation vary widely from program to program but a comprehensive pulmonary rehabilitation program includes exercise training, nutrition counseling, and education. See the individual sections of this synthesis for a discussion of these components.</p> <p><u>Patient Selection and Program Design</u></p> <p>Ideally, pulmonary rehabilitation should involve several types of health professionals. Significant benefits can also occur with more limited personnel, as long as dedicated professionals are aware of the needs of each patient. Benefits have been reported from rehabilitation programs conducted in inpatient, outpatient, and home settings. Considerations of cost and availability most often determine the choice of setting. The educational and exercise training components of rehabilitation are usually conducted in groups, normally with 6 to 8 individuals per class (Evidence D).</p> <p>Note: Refer to the following section of this synthesis for recommendations on patient selection.</p>
NCCCC/NICE (2004)	<p>Pulmonary rehabilitation is defined as a multidisciplinary programme of care for patients with chronic respiratory impairment that is individually tailored and designed to optimise each patient's physical and social performance and autonomy.</p> <p>Grade A - Pulmonary rehabilitation should be made available to all appropriate patients with COPD.</p> <p>Grade D - For pulmonary rehabilitation programmes to be effective, and to improve concordance, they should be held at times that suit patients and in buildings that are easy for patients to get to and have good access for people with disabilities. Places should be available within a reasonable time of referral.</p> <p>Grade D - Patients should be made aware of the benefits of pulmonary rehabilitation and the commitment required to gain these.</p>
SMOH (2006)	<p>Pulmonary Rehabilitation</p> <p>Pulmonary rehabilitation is a structured multidisciplinary program of care for patients with chronic respiratory impairment that is individually tailored and designed to</p>

	<p>optimize physical and social performance and autonomy. Team members include respiratory physicians, family physicians, nurses, physiotherapists, occupational therapists, dieticians, and medical social workers. Pulmonary rehabilitation can be conducted as inpatient, outpatient or home programs. Consideration of cost, availability and accessibility will determine the patient's choice.</p> <p>Studies have shown that COPD patients undergoing pulmonary rehabilitation have experienced the following benefits:</p> <ul style="list-style-type: none"> • Improvement in exercise capacity and functional walking distance • Relief of dyspnoea and fatigue as well as enhancement of mastery (sense of control over condition) • Improvement in health related quality of life • Reduction in the number of hospitalizations and days in hospital • Reduction in anxiety and depression
Patient Selection	
ACCP/AACVPR (2007)	Pulmonary rehabilitation is appropriate for any stable patient with a chronic lung disease who is disabled by respiratory symptoms. Patients with advanced disease can benefit if they are selected appropriately and if realistic goals are set.
GOLD (2008)	<p>Patient Selection and Program Design</p> <p>Although more information is needed on criteria for patient selection for pulmonary rehabilitation programs, COPD patients at all stages of disease appear to benefit from exercise training programs, improving with respect to both exercise tolerance and symptoms of dyspnea and fatigue (Evidence A). Data suggest that these benefits can be sustained even after a single pulmonary rehabilitation program.</p> <p>Benefit does wane after a rehabilitation program ends, but if exercise training is maintained at home, the patient's health status remains above pre-rehabilitation levels (Evidence B). To date there is no consensus on whether repeated rehabilitation courses enable patients to sustain the benefits gained through the initial course.</p> <p>The following points summarize current knowledge of</p>

	<p>considerations important in choosing patients:</p> <p><u>Functional status</u>: Benefits have been seen in patients with a wide range of disability, although those who are chair-bound appear unlikely to respond even to home visiting programs (Evidence A).</p> <p><u>Severity of dyspnea</u>: Stratification by breathlessness intensity using the MRC questionnaire (Figure 5.1-3 in the original guideline document) may be helpful in selecting patients most likely to benefit from rehabilitation. Those with MRC grade 5 dyspnea may not benefit (Evidence B).</p> <p><u>Motivation</u>: Selecting highly motivated participants is especially important in the case of outpatient programs.</p> <p><u>Smoking status</u>: There is no evidence that smokers will benefit less than nonsmokers, but many clinicians believe that inclusion of a smoker in a rehabilitation program should be conditional on their participation in a smoking cessation program. Some data indicate that continuing smokers are less likely to complete pulmonary rehabilitation programs than nonsmokers (Evidence B).</p>
NCCCC/NICE (2004)	<p>Grade D - Pulmonary rehabilitation should be offered to all patients who consider themselves functionally disabled by COPD (usually MRC grade 3 and above). Pulmonary rehabilitation is not suitable for patients who are unable to walk, who have unstable angina, or who have had a recent myocardial infarction.</p>
SMOH (2006)	<p>D - Pulmonary rehabilitation may be considered for patients with the following ("Pulmonary Rehabilitation," 1999; Puhan et al., 2005; Salman et al., 2003):</p> <ul style="list-style-type: none"> • Persistent symptoms especially dyspnoea • Reduced exercise tolerance or experience a restriction in activities • Recurrent admissions to hospitals over the last 6 months <p>(Grade D, Level 4)</p> <p>The following conditions may adversely affect the outcome of pulmonary rehabilitation:</p> <ol style="list-style-type: none"> 1. Conditions that may interfere with the patient undergoing the rehabilitation programme (e.g., advanced arthritis, inability to learn or disruptive behavior).

	<ol style="list-style-type: none"> 2. Conditions that may place the patient at undue risk during exercise training (e.g., severe pulmonary hypertension, unstable angina or recent myocardial infarction). 3. Poorly motivated patients who are unable to complete the entire rehabilitation programme.
Exercise Training	
ACCP/AACVPR (2007)	<p>Exercise training is one of the key components of pulmonary rehabilitation. The exercise prescription for the training program is guided by the following three parameters: intensity; frequency; and duration. The characteristics of exercise programs in pulmonary rehabilitation for patients with COPD have not been extensively investigated.</p> <ul style="list-style-type: none"> • A program of exercise training of the muscles of ambulation is recommended as a mandatory component of pulmonary rehabilitation for patients with COPD. Grade of Recommendation 1A • Six to 12 weeks of pulmonary rehabilitation produces benefits in several outcomes that decline gradually over 12 to 18 months. Grade of Recommendation 1A. Some benefits, such as HRQOL, remain above control at 12 to 18 months. Grade of Recommendation 1C • Longer pulmonary rehabilitation programs (12 weeks) produce greater sustained benefits than shorter programs. Grade of Recommendation 2C • Lower-extremity exercise training at higher exercise intensity produces greater physiologic benefits than lower-intensity training in patients with COPD. Grade of Recommendation 1B • Both low- and high-intensity exercise training produce clinical benefits for patients with COPD. Grade of Recommendation 1A • Addition of a strength training component to a program of pulmonary rehabilitation increases muscle strength and muscle mass. Strength of evidence 1A • Unsupported endurance training of the upper extremities is beneficial in patients with COPD and should be included in pulmonary rehabilitation programs. Grade of Recommendation 1A • The scientific evidence does not support the routine use of inspiratory muscle training as an essential component of pulmonary rehabilitation. Grade of Recommendation 1B • Supplemental oxygen should be used during rehabilitative exercise training in patients with severe exercise-induced hypoxemia. Grade of Recommendation 1C

	<ul style="list-style-type: none"> • Administering supplemental oxygen during high-intensity exercise programs in patients without exercise-induced hypoxemia may improve gains in exercise endurance. Grade of Recommendation 2C • As an adjunct to exercise training in selected patients with severe COPD, noninvasive ventilation produces modest additional improvements in exercise performance. Grade of Recommendation 2B
GOLD (2008)	<p><u>Exercise training.</u> Exercise tolerance can be assessed by either bicycle ergometry or treadmill exercise with the measurement of a number of physiological variables, including maximum oxygen consumption, maximum heart rate, and maximum work performed. A less complex approach is to use a self-paced, timed walking test (e.g., 6-minute walking distance). These tests require at least one practice session before data can be interpreted. Shuttle walking tests offer a compromise: they provide more complete information than an entirely self-paced test, but are simpler to perform than a treadmill test.</p> <p>Exercise training ranges in frequency from daily to weekly, in duration from 10 minutes to 45 minutes per session, and in intensity from 50% peak oxygen consumption (VO₂ max) to maximum tolerated. The optimum length for an exercise program has not been investigated in randomized controlled trials but most studies involving fewer than 28 exercise sessions show inferior results compared to those with longer treatment periods. In practice, the length depends on the resources available and usually ranges from 4 to 10 weeks, with longer programs resulting in larger effects than shorter programs.</p> <p>Participants are often encouraged to achieve a predetermined target heart rate, but this goal may have limitations in COPD. In many programs, especially those using simple corridor exercise training, the patient is encouraged to walk to a symptom-limited maximum, rest, and then continue walking until 20 minutes of exercise have been completed. Where possible, endurance exercise training to 60 to 80% of the symptom-limited maximum is preferred. Endurance training can be accomplished through continuous or interval exercise programs. The latter involve the patient doing the same total work but divided into briefer periods of high-intensity exercise, which is useful when performance is limited by other comorbidities. Use of a simple wheeled walking aid seems to improve walking distance and reduces breathlessness in severely disabled COPD patients (Evidence C). Other approaches to improving outcomes such as use of oxygen during exercise,</p>

	<p>exercising while breathing heliox gas mixtures, unloading the ventilator muscles while exercising, or use of pursed lip breathing remain experimental at present. Specific strength training is possible but its benefits remain uncertain, as do the effects of supplementation with anabolic steroids and the use of neuromuscular electrical stimulation.</p> <p>The minimum length of an effective rehabilitation program is 6 weeks; the longer the program continues, the more effective the results (Evidence B). However, as yet, no effective program has been developed to maintain the effects over time. Many physicians advise patients unable to participate in a structured program to exercise on their own (e.g., walking 20 minutes daily). The benefits of this general advice have not been tested, but it is reasonable to offer such advice to patients if a formal program is not available.</p> <p>Some programs also include upper limb exercises, usually involving an upper limb ergometer or resistive training with weights. There are no randomized clinical trial data to support the routine inclusion of these exercises, but they may be helpful in patients with comorbidities that restrict other forms of exercise and those with evidence of respiratory muscle weakness. The addition of upper limb exercises or other strength training to aerobic training is effective in improving strength, but does not improve quality of life or exercise tolerance.</p>
NCCCC/NICE (2004)	Grade A - Pulmonary rehabilitation programmes should include multicomponent, multidisciplinary interventions, which are tailored to the individual patient's needs. The rehabilitation process should incorporate a programme of physical training, disease education, and nutritional, psychological, and behavioural intervention.
SMOH (2006)	B - The physical components of pulmonary rehabilitation should include both lower extremity training (e.g., bicycle, ergometry, treadmill) and upper extremity training (strength and endurance) ("Pulmonary rehabilitation: joint ACCP/AACVPR evidence-based Guidelines," 1997). (Grade B, Level 2+)
Nutritional Interventions/Counseling	
ACCP/AACVPR (2007)	There is insufficient evidence to support the routine use of nutritional supplementation in pulmonary rehabilitation of patients with COPD. No recommendation is provided
GOLD (2008)	<u>Nutrition counseling</u> . Nutritional state is an important determinant of symptoms, disability, and prognosis in

	<p>COPD; both overweight and underweight can be a problem. Specific nutritional recommendations for patients with COPD are based on expert opinion and some small randomized clinical trials. Approximately 25% of patients with <i>Stage II: Moderate COPD to Stage IV: Very Severe COPD</i> show a reduction in both their body mass index and fat free mass. A reduction in body mass index is an independent risk factor for mortality in COPD patients (Evidence A).</p> <p>Health care workers should identify and correct the reasons for reduced calorie intake in COPD patients. Patients who become breathless while eating should be advised to take small, frequent meals. Poor dentition should be corrected and comorbidities (pulmonary sepsis, lung tumors, etc.) should be managed appropriately. Improving the nutritional state of COPD patients who are losing weight can lead to improved respiratory muscle strength. However, controversy remains as to whether this additional effort is cost effective.</p> <p>Present evidence suggests that nutritional supplementation alone may not be a sufficient strategy. Increased calorie intake is best accompanied by exercise regimes that have a nonspecific anabolic action, and there is some evidence this also helps even in those patients without severe nutritional depletion. Specific nutritional supplements (e.g., creatine) may improve body composition, but further studies in large numbers of subjects are required before the routine use of these supplements can be recommended. Anabolic steroids in COPD patients with weight loss increase body weight and lean body mass but have little or no effect on exercise capacity.</p>
NCCCC/NICE (2004)	Grade A - Pulmonary rehabilitation programmes should include multicomponent, multidisciplinary interventions, which are tailored to the individual patient's needs. The rehabilitation process should incorporate a programme of physical training, disease education, and nutritional, psychological, and behavioural intervention.
SMOH (2006)	D - Psychosocial and behavioral interventions (health education, smoking cessation clinic, and support groups addressing psychosocial issues) as well as nutritional intervention should also be included as non-physical components of the comprehensive pulmonary rehabilitation programs ("Pulmonary Rehabilitation," 1999). (Grade D, Level 4)
Education	
ACCP/AACVPR	Education should be an integral component of pulmonary

(2007)	rehabilitation. Education should include information on collaborative self-management and prevention and treatment of exacerbations. Grade of Recommendation 1B
GOLD (2008)	<u>Education</u> . Most pulmonary rehabilitation programs include an educational component, but the specific contributions of education to the improvements seen after pulmonary rehabilitation remain unclear.
NCCCC/NICE (2004)	Grade A - Pulmonary rehabilitation programmes should include multicomponent, multidisciplinary interventions, which are tailored to the individual patient's needs. The rehabilitation process should incorporate a programme of physical training, disease education, and nutritional, psychological, and behavioural intervention.
SMOH (2006)	D - Psychosocial and behavioral interventions (health education, smoking cessation clinic, and support groups addressing psychosocial issues) as well as nutritional intervention should also be included as non-physical components of the comprehensive pulmonary rehabilitation programs ("Pulmonary Rehabilitation," 1999). (Grade D, Level 4)
Psychosocial/Behavioral Interventions	
ACCP/AACVPR (2007)	<p>The data suggest that depression and anxiety are more common among patients with COPD than in the public at large. Data indicate that psychosocial intervention may facilitate behavioral changes, such as smoking cessation, as well as the management of dyspnea. However, psychosocial interventions alone may not lead to reduced psychological distress.</p> <ul style="list-style-type: none"> • There is minimal evidence to support the benefits of psychosocial interventions as a single therapeutic modality. Grade of Recommendation 2C • Although no recommendation is provided since scientific evidence is lacking, current practice and expert opinion support the inclusion of psychosocial interventions as a component of comprehensive pulmonary rehabilitation programs for patients with COPD.
GOLD (2008)	No specific recommendations offered
NCCCC/NICE (2004)	Grade A - Pulmonary rehabilitation programmes should include multicomponent, multidisciplinary interventions,

	<p>which are tailored to the individual patient's needs. The rehabilitation process should incorporate a programme of physical training, disease education, and nutritional, psychological, and behavioural intervention.</p>
SMOH (2006)	<p>D - Psychosocial and behavioral interventions (health education, smoking cessation clinic, and support groups addressing psychosocial issues) as well as nutritional intervention should also be included as non-physical components of the comprehensive pulmonary rehabilitation programs ("Pulmonary Rehabilitation," 1999). (Grade D, Level 4)</p>
Follow-Up	
ACCP/AACVPR (2007)	<p>Maintenance strategies following pulmonary rehabilitation have a modest effect on long-term outcomes. Grade of Recommendation 2C</p>
GOLD (2008)	<p>Assessment and Follow-up</p> <p>Baseline and outcome assessments of each participant in a pulmonary rehabilitation program should be made to quantify individual gains and target areas for improvement. Assessments should include:</p> <ul style="list-style-type: none"> • Detailed history and physical examination • Measurement of spirometry before and after a bronchodilator drug • Assessment of exercise capacity • Measurement of health status and impact of breathlessness • Assessment of inspiratory and expiratory muscle strength and lower limb strength (e.g., quadriceps) in patients who suffer from muscle wasting <p>The first two assessments are important for establishing entry suitability and baseline status but are not used in outcome assessment. The last three assessments are baseline and outcome measures. Several detailed questionnaires for assessing health status are available, including some that are specifically designed for patients with respiratory disease (e.g., Chronic Respiratory Disease Questionnaire, St. George Respiratory Questionnaire), and there is increasing evidence that these questionnaires may be useful in a clinical setting. Health status can also be assessed by generic questionnaires, such as the Medical Outcomes Study Short Form (SF36), to enable comparison of quality of life in different diseases. The Hospital Anxiety and Depression Scale (HADS) and the Primary Care</p>

	Evaluation of Mental Disorders (PRIME-MD) have been used to improve identification and treatment of anxious and depressed patients.
NCCCC/NICE (2004)	No recommendations offered
SMOH (2006)	No recommendations offered

TABLE 4: BENEFITS AND HARMS	
Benefits	
ACCP/AACVPR (2007)	Appropriate use of pulmonary rehabilitation
GOLD (2008)	Appropriate diagnosis, management, and prevention of COPD
NCCCC/NICE (2004)	If adopted, these guideline recommendations should lead to better standards of care and thus better outcomes from COPD.
SMOH (2006)	Appropriate diagnosis and management of patients with COPD

TABLE 5: EVIDENCE RATING SCHEMES AND REFERENCES	
ACCP/AACVPR (2007)	<p>High (A) Evidence based on well designed randomized controlled trials (RCTs) yielding consistent and directly applicable results. In some circumstances, high-quality evidence can be the result of overwhelming evidence from observational studies.</p> <p>Moderate (B) Evidence based on RCTs with limitations that may include methodological flaws or inconsistent results. Studies other than RCTs that may yield strong results are also included in the moderate-quality category.</p> <p>Low (C) Evidence from other types of observational studies (the weakest type of evidence).</p>

	Strength of Recommendations 1A - Strong recommendation 1B - Strong recommendation 1C - Strong recommendation 2A - Weak recommendation 2B - Weak recommendation 2C - Weak recommendation	
GOLD (2008)	Description of Levels of Evidence A. <i>Sources of Evidence:</i> Randomized controlled trials (RCTs). Rich body of data. <i>Definition:</i> Evidence is from endpoints of well-designed RCTs that provide a consistent pattern of findings in the population for which the recommendation is made. Category A requires substantial numbers of studies involving substantial numbers of participants. B. <i>Sources of Evidence:</i> Randomized controlled trials. Limited body of data. <i>Definition:</i> Evidence is from endpoints of intervention studies that include only a limited number of patients, posthoc or subgroup analysis of RCTs, or meta-analysis of RCTs. In general, Category B pertains when few randomized trials exist, they are small in size, they were undertaken in a population that differs from the target population of the recommendation, or the results are somewhat inconsistent. C. <i>Sources of Evidence:</i> Nonrandomized trials. Observational studies. <i>Definition:</i> Evidence is from outcomes of uncontrolled or nonrandomized trials or from observational studies. D. <i>Sources of Evidence:</i> Panel consensus. Judgment. <i>Definition:</i> This category is used only in cases where the provision of some guidance was deemed valuable but the clinical literature addressing the subject was deemed insufficient to justify placement in one of the other categories. The Panel Consensus is based on clinical experience or knowledge that does not meet the above-listed criteria.	
NCCCC/NICE (2004)	Hierarchy of Evidence	Grading of Recommendations

	Level	Type of Evidence	Grade	Evidence
	Ia	Evidence from systematic reviews or meta-analysis of randomized controlled trials	A	Based on hierarchy I evidence
	Ib	Evidence from at least one randomized controlled trial		
	IIa	Evidence from at least one controlled study without randomization	B	Based on hierarchy II evidence or extrapolated from hierarchy I evidence
	I Ib	Evidence from at least one other type of quasi-experimental study		
	III	Evidence from non-experimental descriptive studies, such as comparative studies, correlation studies and case-control studies	C	Based on hierarchy III evidence or extrapolated from hierarchy I or II evidence
	IV	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities	D	Directly based on hierarchy IV evidence or extrapolated from hierarchy I, II or III evidence
	NICE	Evidence from NICE guidelines or Health Technology Appraisal	NICE	Evidence from NICE guidelines or Health Technology

				Appraisal programme
	HSC	Evidence from Health Service Circulars	HSC	Evidence from Health Service Circulars
SMOH (2006)	<p>Levels of Evidence</p> <p>Level 1++: High quality meta-analyses, systematic reviews of randomized controlled trials (RCTs), or RCTs with a very low risk of bias.</p> <p>Level 1+: Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias.</p> <p>Level 1-: Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias</p> <p>Level 2++: High quality systematic reviews of case control or cohort studies. High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal</p> <p>Level 2+: Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal</p> <p>Level 2-: Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal</p> <p>Level 3: Non-analytic studies (e.g., case reports, case series)</p> <p>Level 4: Expert opinion</p> <p>Grades of Recommendation</p> <p>Grade A: At least one meta-analysis, systematic review of randomized controlled trials (RCTs), or RCT rated as 1++ and directly applicable to the target population; or</p> <p>A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results</p> <p>Grade B: A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating</p>			

	<p>overall consistency of results; or</p> <p>Extrapolated evidence from studies rated as 1++ or 1+</p> <p>Grade C: A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or</p> <p>Extrapolated evidence from studies rated as 2++</p> <p>Grade D: Evidence level 3 or 4; or</p> <p>Extrapolated evidence from studies rated as 2+</p> <p>GPP (good practice points): Recommended best practice based on the clinical experience of the guideline development group.</p>
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GUIDELINE CONTENT COMPARISON

Areas of Agreement

Patient Selection

There is overall agreement that pulmonary rehabilitation is appropriate for stable patients considered to be functionally disabled by the symptoms of COPD. SMOH notes that it may be considered for patients with persistent symptoms (especially dyspnea), reduced exercise tolerance or experience a restriction in activities, or recurrent admissions to hospitals over the last 6 months. Both GOLD and NCCCC/NICE note that the Medical Research Council (MRC) dyspnoea scale may be helpful in selecting patients most likely to benefit. NCCCC/NICE states that patients for whom pulmonary rehabilitation is appropriate will usually have an MRC grade of 3 and above; GOLD notes that those with MRC grade 5 dyspnea may not benefit. There is also overall agreement that pulmonary rehabilitation is most likely not suitable for patients with certain conditions, such as an inability to walk, unstable angina, or recent myocardial infarction. ACCP does not provide specific exclusion criteria for selecting patients who may benefit from pulmonary rehabilitation, but notes that patients with advanced disease can benefit if they are selected appropriately and if realistic goals are set. There is also overall agreement that the patient's motivation may be an important factor to consider while determining suitability.

Exercise Training

There is overall agreement between the guideline groups that exercise training is the cornerstone of any pulmonary rehabilitation program and should include both lower and upper extremity training. ACCP/AACVPR and GOLD provide recommendations regarding the duration of programs, and agree that the longer a

program continues, the more effective the results. ACCP/AACVPR notes that six to 12 weeks of pulmonary rehabilitation produces benefits in several outcomes that decline gradually over 12 to 18 months, and that programs lasting at least 12 weeks produce greater sustained benefits than shorter programs. GOLD provides slightly different figures, but similarly notes that the minimum length of an effective rehabilitation program is 6 weeks. They add that in practice, the length depends on the resources available and usually ranges from 4 to 10 weeks, with longer programs resulting in larger effects than shorter programs. GOLD adds that if no formal program is available to patients, it is reasonable for physicians to advise them to exercise on their own. ACCP/AACVPR also provides recommendations regarding the use of supplemental oxygen and noninvasive ventilation in patients involved in pulmonary rehabilitation.

Nutritional Interventions/Counseling

The four guideline groups agree that nutritional intervention is an appropriate component of most pulmonary rehabilitation programs. GOLD is in agreement with the one recommendation ACCP/AACVPR makes on this topic, which is that there is insufficient evidence to support the routine use of nutritional supplementation in pulmonary rehabilitation patients. GOLD goes into greatest detail, providing recommendations for the identification and correction of reduced calorie intake in COPD patients. They note that a reduction in body mass index is an independent risk factor for mortality in COPD patients. NCCCC/NICE and SMOH recommend that nutritional intervention be included in a program of pulmonary rehabilitation, but do not provide specific recommendations.

Education

There is overall agreement between the guideline groups that education should be included in pulmonary rehabilitation programs. ACCP/AACVPR states that education should include information on collaborative self-management and prevention and treatment of exacerbations. GOLD, NCCCC/NICE and SMOH recommend that education be included in a program of pulmonary rehabilitation, but do not provide specific recommendations. GOLD states that although most pulmonary rehabilitation programs include an educational component, the specific contributions of education to the improvements seen after pulmonary rehabilitation remain unclear.

Psychosocial Interventions

ACCP/AACVPR, NCCCC/NICE, and SMOH agree that psychosocial/behavioral interventions should be included in pulmonary rehabilitation programs. ACCP/AACVPR notes that while there is minimal evidence to support psychosocial interventions as a single therapeutic modality, current practice and opinion do support their inclusion as a component of comprehensive pulmonary rehabilitation programs. SMOH recommends that interventions such as smoking cessation clinics and support groups addressing psychosocial issues be included; NCCCC/NICE does not provide specific recommendations.

Follow-Up

ACCP/AACVPR notes that maintenance strategies following pulmonary rehabilitation have a modest effect on long-term outcomes. GOLD goes into the greatest detail, recommending baseline and outcome assessments be performed to quantify individual gains and target areas for improvement. They cite specific elements that should be included in the assessments, and note that questionnaires can be useful tools in performing recommended assessments. NCCCC/NICE and SMOH do not provide recommendations.

Areas of Differences

There are no significant areas of difference between the guideline groups.

This synthesis was prepared by ECRI Institute on October 30, 2007. It was reviewed by ACCP/AACVPR on November 23, 2007, by GOLD on December 19, 2007, and by SMOH on December 21, 2007. This synthesis was revised in June 2008 and June 2009 to update GOLD recommendations.

Internet citation: National Guideline Clearinghouse (NGC). Guideline synthesis: Chronic Obstructive Pulmonary Disease (COPD) Part III. Pulmonary Rehabilitation. In: National Guideline Clearinghouse (NGC) [website]. Rockville (MD): 2007 Dec (revised 2009 Jul). [cited YYYY Mon DD]. Available: <http://www.guideline.gov>.



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Date Modified: 7/27/2009